FAX/DATA MODEM
USER'S MANUAL

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i.1 FCC General Information

The Federal Communications Commission (FCC) of the United States restricts specific uses of modems, and places registration responsibilities on both the manufacturer and the individual user:

1. The modem may not be connected to a party line or to a coin operated telephone.

2. The modem manufacturer must make any repairs to the modem to maintain valid FCC registration.

3. Notification to the telephone company is no longer required prior to connecting registered equipment, but upon request from the telephone company, the user shall tell the telephone company which line the equipment is connected to as well as the registration number and ringer equivalence number of the registered protective circuitry. FCC information is printed on a label on the bottom of the modem.

i.2 FCC Notice

This equipment has been tested and found to comply with the limits for a digital device, pursuant to Subpart B of Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates and uses radio frequency energy and if not installed with the instructions, may cause interference to radio communications.

However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try and correct the interference by one or more of the following measures:

Reorient or relocate the receiving antenna.

Increase the separation between the equipment and receiver.

Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

Consult the dealer or an experienced radio/TV technician for help.

Shielded interconnect cables and a shielded power cord must be employed with this equipment to insure compliance with the pertinent RF emission limits governing this device. Changes or modifications not expressly approved by the manufacturer could void the user? authority to operate this equipment.

NOTE : The manufacturer is not responsible for any radio or T.V. interference caused by unauthorized modifications to this equipment. Such modifications could void the user? authority to operate the equipment.

i.3 DOC Notice

Notice: The Canadian Department of Communications label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational and safety requirements. The Department does not guarantee the equipment will operate to the user? satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company? inside wiring associated with a single line individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

Caution: Users should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate.

The Load Number (LN) assigned to each terminal device denotes the percentage or the total load to be connected to a telephone loop which is used by the device, to prevent overloading. The termination on a loop may consist of any combination of devices subject only to the requirement that the total of the Load Numbers of all the devices does not exceed 100.

1 - INTRODUCTION

Congratulations on your purchase of this outstanding Fax/Data Modem. This manual describes how to operate your new Fax/Data Modem.

Instructions for installing your Fax/Data Modem will be found in the Installation Manual, while the information in this manual, deals exclusively with the operation of the modem after it is installed, such as the command set, the internal configuration registers, troubleshooting and testing.

Features:

These Fax/Data Modems combine the features of a 56000(receive only)/33600/28800/14400/9600 bps data modem and a 14400/9600 bps FAX modem. Your new Fax/Data Modem gives your personal computer the ability to send and receive FAX messages over the telephone line like a standard FAX machine. Your Fax/Data Modem also allows your PC to communicate with other personal computers, terminals or BBS? (Bulletin Board Systems) through the data modem functions.

When used as a data modem your Fax/Data Modem uses the standard AT command set and is fully compatible with ITU-T V.42, V.42bis, V.34 , V.32bis, V.32, V.22bis, V.23, V.22, V.21, MNP 2-5, Bell 103, 212A, K56flex, and V.90. When used as a Fax Modem it communicates with all ITU-T Group 3 FAX machines and is compatible with ITU-T V.27ter and V.29, V.17, T.4 and T.30. Switching between DATA mode operation and FAX mode operation of your Fax/Data Modem is done through its firmware, no hardware settings are required.

If you are already familiar with the use of a modem and the Hayes AT command set, this modem will be extremely easy for you to use. Just read the installation procedures in the installation manual and you are ready to begin operation. If you are new to modem communications, we recommend that you read through this manual first. If you come across terms that you don't understand, consult the glossary. Words in boldface type are command names, commands, or default settings. Carriage returns (Enter) are noted with <CR> or [ENTER]; this does not mean to enter these characters literally; but instead to press the Enter key.

The communication software which should be used depends on the kind of machine that you are going to communicate with. If you are going to call a FAX machine then you must use the Fax software. If the machine that you are going to communicate with is a modem then you must use a data modem communications software.

This manual is written to be used for several models of Fax/Data Modems. Some of the information in this manual may not apply to your Fax/Data modem.

2 - COMMAND REFERENCE

This chapter provides an alphabetized reference with examples for all commands for the modem. The system of commands is depicted below in Figure 2-1.

To use these commands for dialing or configuring the modem, make sure the communications software package you will be using lets you operate the modem through its internal commands. If your software permits use of the modem internal commands, read this chapter. If not, read your software user? manual and ignore the rest of this manual.

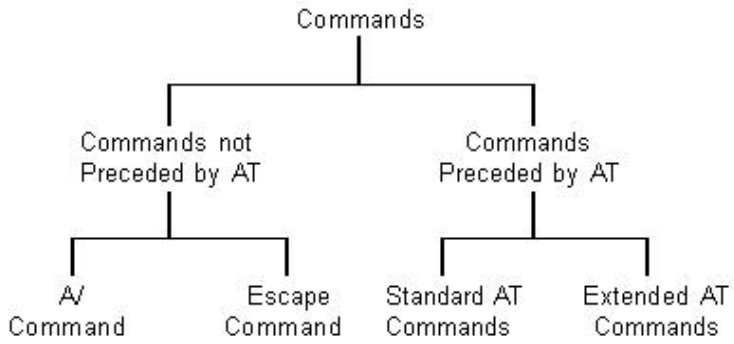

Fig.2-1 System of Commands

2.1 General Command Information

Except for the **A/** command and the +++ escape command described in Section 2.4, all commands must be prefixed with the attention code **AT**. For instance, the **A** command (below) would be entered as: ?**T A<CR>**". Without the AT prefix, the command line cannot be executed. Once entered, AT cannot be deleted with the **Backspace** or **Delete** key.

More than one command can be placed on a single line and, if desired, separated with spaces for readability. Once the carriage return (**Enter**) key is pressed, the command line is executed. A line with no carriage return is ignored.

The modem accepts either upper or lower case characters in the command line and ignores any spaces within or between commands. Typing errors can be corrected with the **Backspace** key. Exceptions are noted in the description of specific commands.

Variables (r and x) are listed in italics. Punctuation symbols (**, ; ! @**) use as dial modifiers are listed alphabetically according to their English names at the beginning of Section 2.3. Where two commands are separated by a slash, either command will have the same effect. For example, if the command is listed as **H0/H**, issuing either **H0 or H** will have the same effect.

2.2 AT Commands

A Go On-line in Answer Mode

This command instructs the modem to go off-hook immediately and then make a handshake with the remote modem. Handshaking is not available during leased line operation.

A is usually used to manually answer an incoming call or to switch from voice conversation to data communication.

D Go On-line in Originate Mode

D instructs the modem to go off-hook immediately and automatically dial the number contained in the dial string following **D**. The dial string may contain any of the dial modifiers contained in the following section. The **D** command without a dial string is usually used to switch from voice conversation to data communication or to call a remote modem in leased-line operation mode.

En Command Echo

E0/E	Disables command echo.
E1	Enables command echo. (default)

Hn Hang Up

H0/H	Goes on-hook. (hangs up)
H1	Goes off-hook. (ready to dial)

In Identification

I0/I	Report the product code.
I1	Report the hardware checksum.
I2	Reports "OK".
I3	Report firmware revision.
I4	Report OEM defined identifier string.
I5	Report Country Code parameter.
I6	Report modem data pump model and internal code revision.
I7	Reports "OK".

Ln Control Speaker Volume

L0/L	Low volume.
L1	Low volume. (default)
L2	Medium volume.
L3	High volume.

Mn Monitor Speaker On/Off

M0/M	Speaker is always off.
M1	Speaker is off while receiving carrier. (default)
M2	Speaker is always on.
M3	Speaker is off when dialing or receiving carrier.

On Return to On-Line Data Mode

O0/O	Enters on-line data mode without a retrain. Handling is determined by the Call Establishment task. Generally, if a connection exists, this command connects the DTE back to the remote modem after an escape (**+++**).
O1	Enters on-line data mode with a retrain before returning to on-line data mode.

P Set Pulse Dial as Default

Causes the modem to assume that all subsequent dial commands are pulse dials. You may omit the " P " from the dial strings.

Q Result Code Display

Determines whether the modem sends the result codes to the DTE.

Q0/Q	Enables result codes to the DTE (default).
Q1	Disables result codes to the DTE.

Sn Read / Writing S Registers

Sn?	Reports the value of S-Parameter n.
Sn=x	Set S parameter n to the value x Writes the value of x to the specified S register. All the registers will return the OK response if x is a legal value. However some registers will not actually write the value.

T Set Tone Dial as Default

Causes the modem to assume that all subsequent dial commands are tone dial.

Vn Select Word or Digit Result Codes

V0/V	Displays result codes in digital format.
V1	Displays result codes in verbose format. (default)

Wn Connect Message Control

This command controls the format of CONNECT messages. The paramater value,if valid,is written to **S31** bits 2 and 3. Note that the **Wn** command can be overridden by register **S95** bits(see **S95** description).

W0	Upon connection, the modem reports only the DTE speed(e.g.,CONNECT 19200). Subsequent responses are disable.(default)
W1	Upon connection, the modem reports the line speed, the error correction protocol, and the DTE speed, respectively. Subsequent responses are disable.
W2	Upon connection, the modem reports the DCE speed(e.g.,CONNECT 14400).Subsequent responses are disabled.

Xn Extended Result Codes

This command selects which subset of the result messages will be used by the modem to inform the DTE of the results of commands.

Blind dialing is enabled or disabled by country parameters. If the user wishes to enforce dial tone detection, a "W" can be placed in the dial string(see D command). Note that the information below is based upon the default implementation of the X results table.

If the modem is in facsimile mode (+FCLASS=1) , the only message sent to indicate a connection is CONNECT without a speed indication.

X0/X	CONNECT result code is given upon entering online data state. Dial tone and busy detection are disable.
X1	CONNECT<text> result code is given upon entering online data state. Dial tone and busy detection are disable.
X2	CONNECT<text> result code is given upon entering online data state. Dial tone detection is enabled, and busy detection is disable.
X3	CONNECT<text> result code is given upon entering online data state. Dial tone detection is disabled, and busy detection is enable.
X4	CONNECT<text> result code is given upon entering online data state. Dial tone and busy detection are enable.(default)

Z Reset to Default Configuration

This command must be placed at the end of the command line, resets the active configuration of the modem to the stored configuration saved in non-volatile RAM, hangs up the modem, and clears the command buffer.

2.2.a Commands Preceded by &

&Cn Select DCD Options

&C0/&C	DCD (Data Carrier Detect) is always ON .
&C1	DCD follows the state of the carrier. (default)

&Dn Select DTR Options

Determines actions taken by the modem in relation to the Data Terminal Ready (DTR) signal of the serial port.

&D0/&D	Modem ignores DTR.
&D1	DTR drop causes the modem enters online command state and the call remains connected.
&D2	DTR drop causes the modem to hang up. Auto answer is inhibited. (default)

&F Fetch Factory Configuration

Set all parameters to factory default values.

&Gn Select Guard Tone

&G0/&G - G1	Disable guard tone. (default)
&G2	Select 1800Hz guard tone.

&Kn DTE/Modem Flow Control

Determines how the modem controls the flow of data between the local DTE and the modem. When the modem terminal buffer is nearly full, the modem will either sendn XOFF or drop CTS to stop the data flow. When the buffer is nearly empty, the modem will either send an XON or raise CTS to start the data flow.

&K0/&K	Disable DTE/DCE flow control.
&K3	Enable RTS/CTS DTE/DCE flow control.
&K4	Enables XON/XOFF DTE/DCE flow control.
&K5	Enables transparent XON/XOFF DTE/DCE flow control.

&Pn Select Pulse Dial Make/Break Ratio

&P0/&P	Sets a 39/61 make/break ratio at 10 pulses per second @ 10 pps - used in USA. (default)
&P1	Sets a 33/67 make/break ratio @ 10 pps.
&P2	Sets a 39/61 make/break ratio @ 20 pps.
&P3	Sets a 33/67 make/break ratio @ 20 pps.

&V View Configuration Profiles

Displays the current (active) configuration and the stored profile.

&W Store the Current Configuration to Nonvolatile RAM

This command saves the current (active) configuration, including S-Parameters in non-volatile RAM.

&W0/&W	Store the current configuration as profile 0.
&W1	Store the current configuration as profile 1.

2.2.b Commands Preceded by \

\Nn Operation Mode Control

Selects the operating mode to be used during connection

\N0	Selects Normal (speed buffering) Mode.
\N1	Selects Direct (pass-through) Mode.
\N2	Selects Reliable Link Mode.
\N3	Selects Auto-reliable Mode. Modem attempts to connect with error correction.
\N4	Select LAPM error-correction mode.
\N5	Select MNP error-correction mode.

2.2.c Commands Preceded by %

%C Enable/Disable Data Compression

Enables or disable data compression negotiation.The modem can only perform data compression on an error corrected link.The parameter value, if valid, is written to S41 bits 0 and 1.

%C0	Disables data compression.

%C1 Enables MNP 5 data compression negotiation.

%C2 Enables V.42 bis data compression.

%C3 Enables both V.42 bis and MNP 5 data compression. (default)

%En Enable/Disable Line Quality Monitor and Auto-Retrain or Fallback/Fall Forward

Control whether or not the modem will automatically monitor the line quality and request a retrain (**%E1**) or fall back when quality is insufficient or fall forward when line quality is sufficient (**%E2**)., the modem attempts to retrain for a maximum of 30 seconds.

%E0%E Disable line quality monitor, auto-retrain, and auto-rate renegotiation .

%E1 Enable line quality monitor, auto-retrain, and auto-rate renegotiation.

%E2 Enable line quality monitor and fallback/fall forward.(Default)

%L (Option) Line Signal Level

Returns a value identifying the received signal level. The possible values are:

009 -9 dBm.

010 -10 dBm.

011 -11 dBm.

043 -43 dBm.

%Q (Option) Line Signal Quality

Reports the line signal quality (DAA dependent). Returns the higher order byte of the EQM value. Based on the EQM value, retain or fallback/fall forward may be initiated if enabled by **%E1** or **%E2**.

2.2.d Commands Preceded by +

+EB Break Handing in Error control Operation

This extended format compound parameter control the break handing in V.42 operation.

Syntax

+EB = [<break_selection>[,<timed>[,<default_length>]]]

Defined Values

<break_selection> :

0 Specifying that break is to be ignored i.e., not signal to remote DCE

<timed> :

0 Specifying that any transmitted V.42 L-SIGNAL will not indicate break signal length

<default_length> :

0 Specifying that break is not delivered to the DTE

+DR Data Compression Reporting

Syntax

+DR=[<value>]

Defined Values

<value>

0 **:** Data Compression reporting disabled

1 **:** Data Compression reporting enabled (default)

Error control reporting is as bellows:

+DR: NONE Data Compression not in use

+DR: V42B V.42bis is in use in both direction.

+DR: ALT MNP 5 Compression

+DS Data Compression

Syntax

+DS=[<direction>[,<compr_neg>[,<max_dict>[,<max_string>]]]]

Defined Values

<direction> Specifies the desired directions of operation of the dada compression function; from the DTE point of view.

0 **:** Negotiated ;no compression (V.42bis P0=0).

3 **:** Both directions, accept any direction (V.42bis P0=11).(default)

<compr_neg> Specifies whether or not the modem should continue to operate if the desired result is not obtained

0 **:** Do not disconnect if V.42bis is not negotiated by the remote modem as specifies in <direction>.

<max_dict> Specifies the maximum number of dictionary entries (2048 entries) which should be negotiated.

<max_string> Specifies the maximum string length (32 bytes) to be negotiated (V.42bis P2).

Data Compression reporting is as bellows:

+DS: NONE Data compression is not in use

+DS: V42B V.42bis is in use in both directions.

+DS: ALT MNP 5 compression

+ER Error Control Reporting

Syntax

+ER=[<value>]

Defined Values

<value>

0 **:** Error control reporting disabled (default)

1 **:** Error control reporting enabled

Error control reporting is as bellows:

+ER: NONE Error control is not in use

+ER: LAPM V.42 LAPM protocol is in use.

+ER: ALT MNP is in use

+ES Error Control and Synchronous Mode Selection

Syntax

+ES=[< orig_rqst>[,<orig_fbk>[,<ans_fbk>]]]

Defined Values

<orig_rqst> : Specifies the initial requested mode of operation when the modem is operating as the original

0 Initiate call with Direct Mode.

1 Initiate call with Normal Mode (also referred to as Buffered Mode) only.

2 Initiate V.42 without Detection Phase. If V8 is in use, disable V.42 Detection Phase.

3 Initiate V.42 with Detection Phase.(default)

4 Initiate MNP.

6 Initiate V.80 Synchronous Access Mode when connection is completed, and Date State is entered.

7 Initiate Frame Tunneling Mode when connection is complete, and Data Mode is entered.

<orig_fbk> : Specifies the acceptable fallback mode of operation when the modem is operating as the original

0 LAPM, MNP, or Normal Mode error control optional. (default)

1 LAPM , MNP or Direct Mode error control optional.

2 LAPM or MNP error control required; disconnect if error control is not established.

3 LAPM error control required; disconnect if error control is not established.

4 MNP error control required; disconnect if error control is not established.

<ans_fbk> : Specifies the acceptable fallback mode of operation when the modem is operating as the answer or specifies V.80 Synchronous Access Mode.

0 Direct Mode.

1 Error control disabled, use Normal Mode

2 LAPM, MNP, or Normal Mode error control optional. (default)

4 LAPM or MNP error control required; disconnect if error control is not established.

5 LAPM error control required; disconnect if error control is not established.

6 MNP error control required; disconnect if error control is not established.

8 Initiate V.80 Synchronous Access Mode when connection is completed, and Date State is entered..

9 Initiate Frame Tunneling Mode when connection is complete, and Data Mode is entered.

+IFC DTE-Modem local Flow Control (XON/XOFF)

Syntax

+IFC=< modem_by_DTE >,< DTE_by_modem >

Defined Values

< modem_by_DTE > : Specifies the method to be used by the DTE to control the flow of received data from the modem.

0 none

1 XON/XOFF on transmitted data ;don't pass XON/XOFF characters to the remote modem

2 CTS/RTS (default)

3 XON/XOFF on transmitted data with XON/XOFF characters being passed through to the remote modem in addition to being acted upon for local flow control

< DTE_by_modem > : Specifies the method to be used by the modem to control the flow of transmitted data from the DTE

0 none

1 XON/XOFF on received data.

2 CTS/RTS (default)

+MR Modulation Reporting control

This extended-format compound parameter controls whether or not the extended format +MCR:<carrier> and +MRR<rate> intermediate result codes are transmitted from the modem to the DTE after finish connecting.

Syntax

+MR=<value>

Defined Values

<value>

0 **:** Disables reporting of modulation connection (+MCR: and +MRR: are not transmitted).
(default)

1 **:** Enables reporting of modulation connection (+MCR: and +MRR: are transmitted with tx rate,rx rate). The connecting report syntax is as following:

+MCR: <carrier>
+MRR: <tx_rate>,<rx_rate>

2 **:**Enables reporting of modulation connection (+MCR: and +MRR: are transmitted with rx rate only).

For example :

+MCR: V34

+MRR: 33600,56000

CONNECT 115200

Command : **+MR?**
Response : +MR: <current value>
For example :, +MR: 1

Command : **+MR=?**
Response : +MR: (<value> range)
For example :, +MR: (0-2)

+MS Modulation Selection

This extended-format compound parameter controls the manner of operation of modulation capabilities in the modem. The command format is:

Syntax

+MS=[<carrier>,[<automode>,[<min_tx_rate>,[<max_tx_rate>,[<min_rx_rate>,[<max_rx_rate>]]]]]]<CR>

Defined Values

<**carrier**> **:** Specifies the preferred modem carrier in originating or answering a connection.

			Possible Rates (bps)
B103	**:**	For Bell 103	(300)
B212	**:**	For Bell 212	(1200)
V21	**:**	For V.21	(300)
V22	**:**	For V.22	(1200)
V22B	**:**	For V.22bis	(2400,1200)
V23C	**:**	For V.23	(1200)
V32	**:**	For V.32	(9600,4800)
V32B	**:**	For V.32bis	(14400,12000,9600,7200,4800)
V34	**:**	For V.34	(33600, 31200, 28800, 26400, 24000, 21600, 19200, 16800, 14400, 12000, 9600, 7200, 4800, 2400)
K56FLEX	**:**	For K56flex	(56000, 54000, 52000, 50000, 48000, 46000, 44000, 42000, 40000, 38000, 36000, 34000, 32000)(default)
V90	**:**	For V90	(56000,54667,53333,52000,50667,49333,48000, 46667,45333,42667,41333,40000,38667,37333, 36000,34667,33333,32000,30667,29333,28000)

<automode> : Enable or disable automatic modulation negotiation using V.8 or V.32 bis Annex A.

0 : Automode disabled
1 : Automode enabled, with V.8 bis/V.8 or V.32bis Annex.(default)

For <automode> = 0

a. If <max_rate> is within the rates supported by the selected modulation, the selected rated is that specified by <max_rate>. For example:

+MS=V32B, 0, 1200, 4800 selects V.32 bis 4800 bps fixed rate.

b. If <max_rate> is greater than the highest speed supported by the modulation specified by <mod>, the starting rate is the highest rate supported by the selected modulation. For example,

+MS=V32B, 0, 2400, 28800 selects V.32 bis 14400, 12000, 9600, 7200, or 4800 bps.

For <automode> = 1

a. If <max_rate> is greater than the highest rate supported by the modulation specified by <mod>, the modem automodes down from the highest rate of the selected modulation. For example:

+MS=V32B, 1, 1200, 24000 selects automoding down from V.32 bis 14400 bps.

b. The modem connects at the highest possible rate in accordance with V.8 bis/ V.8, or v32 bis Annex A if V.8 bis / V.8 is not supported by the remote modem. For example:

<min_tx_rate> : Optional numeric values which specify the lowest rate at which the modem may establish a connection. Values for this parameter are decimal encoded, in units of bps. The value range is 75-33600.(Default = Lowest rate supported by the selected carrier.)

<max_tx_rate> : Optional numeric values which specify the highest rate at which the modem may establish a connection. Values for this parameter are decimal encoded, in units of bps. The value range is 75-33600.(Default = Highest rate supported by the selected carrier.)

<min_rx_rate> : Optional numeric values which specify the lowest rate at which the modem may establish a connection. Values for this parameter are decimal encoded, in units of bps. The value range is 75-56000.(Default = Lowest rate supported by the selected carrier.)

<max_rx_rate> : Optional numeric values which specify the highest rate at which the modem may establish a connection. Values for this parameter are decimal encoded, in units of bps. The value range is 75-56000.(Default = Highest rate supported by the selected carrier.)

Reporting Supported Options

The modem can send a string of information to the DTE consisting of supported options.

Command :

+MS?

Response :

+MS : <carrier>,<automode>,<min_tx_rate>,<max_tx_rate>,<min_rx_rate>,<max_rx_rate>

For example :,

+MS : K56,1,75,33600,75,56000

Command :

+MS=?

Response :

+MS : <carrier>,<automode>,<min_tx_rate>,<max_tx_rate>,<min_rx_rate>,<max_rx_rate>

For example :,

+MS : <B103,B212,V21,V22,V22B,V23C,V32,V32B,V34,K56,V90>,<0,1>,<750-33600>,
<75-33600>,<75-56000>,<75-56000>

Making connections to PCM servers

+MS =	-V90 =	PCM Server	Resulting Connection
V90	1	K56flex	K56flex
V90	1	V.90 only	V90
V90	1	Dual	V90
K56	1	K56flex	K56flex
K56	1	V.90 only	V.90
K56	1	Dual	K56flex
V90*	0	K56flex	K56flex
V90*	0	V.90 only	V34
V90*	0	Dual	K56flex
K56	0	K56flex	K56flex
K56	0	V.90 only	V.34
K56	0	Dual	K56flex

* Modem responds ERROR to this command and only supports K56flex mode.

2.3 Dial Modifiers

This section describes all of the dial modifiers which are used in dial strings.

@ Answer

"**@**", placed after a phone number, this modifier tells the modem to wait for 5 seconds of silence before dialing the next number in the dial string. **@** is usually used to access a secure computer system that provides a silent answer as permission for further entrance.

, Pause

"**,**", placed anywhere in the dial string, tells the modem to pause for the number of seconds specified by S-register S8 before processing the rest of the dial string.

! Initiate a Hookflash

"**!**", placed anywhere in the dial string, tells the modem to initiate a hookflash, which means to hang up for 0.5 seconds and then go off-hook again before processing the rest of the dial string. This modifier allows access to PBX features like call transferring .

; Return to Command State after Dialing

"**;**", which must be placed at the end of the dial string, returns to the command state after dialing the number placed ahead of it. A long telephone number would overflowthe 40 character command buffer if placed all in one command line, so it must be broken into two or more command lines. Each part includes part of the number, and all but the last command line end with the "**;**" followed by a carriage return.

^ Tone Control

Toggles calling tone enable/disable:applicable to current dial attempt only.

L Re-dial Last Number

The modem will re-dial the last valid telephone number. The **L** must be immediately after the **D** with all the following characters ignored.

P Pulse Dialing

P, placed ahead of a number, tells the modem to dial a number using pulse dialing.

T Touchtone Dialing

T, placed ahead of a number, tells the modem to dial a number using touchtone dialing.

W Wait for Dialtone

W, placed after a number, tells the modem to wait up to 30 seconds to detect a one-second continuous dialtone before dialing the next number. **W** is most often used in a PBX system to wait for the dialtone of an outside telephone line.

( ) Ignored

- Ignored

<space> Ignored

2.4 Commands Not Preceded By AT

Two commands, A/ and +++, are neither preceded by the attention code **AT** nor followed by a carriage return.

A/ Repeat Command

A/ repeats the execution of the last command line stored in the command buffer. If the last command line is invalid, the ERROR result code will appear on the screen. Note that **A/** cannot be preceded by **AT**; if it is, ERROR will appear on the screen.

+++ Escape

+++ returns to the on-line command state (command state without breaking the established connection) from the on-line state.

When the modem has established a connection and has entered on-line data mode, it is possible to break into the data transmission in order to issue further commands to the modem in an on-line command mode. This is achieved by the DTE sending to the modem a sequence of three ASCII characters specified by register S2. The default character is '+'. The maximum time allowed between receipt of the last character of the three escape character sequence from the DTE and sending of **OK** result code to the DTE is controlled by the S12 register.

2.5 Result Codes

The modem sends a response to the user via the screen after a command is issued. As shown in the figure below, there are two forms for each result code: Modem Response code and digit code.

Modem Response	Digit	Description
OK	0	Command executed without errors
CONNECT	1	Connect to another modem
RING	2	Detect an incoming ring
NO CARRIER	3	Carrier lost or never detected
ERROR	4	Invalid command or invalid character
CONNECT 1200	5	Connection established at 1200 bps
NO DIALTONE	6	Dial tone not detected within time-out
BUSY	7	Detected a busy tone after dialing
NO ANSWER	8	No ring-back or quiet answer was detected by the modem
CONNECT 600	9	Connection established at 600 bps
CONNECT 2400	10	Connection established at 2400 bps
CONNECT 4800	11	Connection established at 4800 bps
CONNECT 9600	12	Connection established at 9600 bps
CONNECT 7200	13	Connection established at 7200 bps
CONNECT 12000	14	Connection established at 12000 bps
CONNECT 14400	15	Connection established at 14400 bps
CONNECT 19200	16	Connection established at 19200 bps
CONNECT 38400	17	Connection established at 38400 bps
CONNECT 57600	18	Connection established at 57600 bps
CONNECT 115200	19	Connection established at 115200 bps
CONNECT 230400	20	Connection established at 230400 bps
CONNECT 1200RX/75TX	22	V.23 connection established : transmit at 75 bps, receive at 1200 bps
CONNECT 75RX/1200TX	23	V.23 connection : transmit at 1200 bps, receive at 75 bps
DELAYED	24	Call fails to connect and number dialed is considered 'delayed' due to country blacklisting requirements
BLACKLISTED	32	Call fails to connect and the number dialed is considered 'blacklisted'
FAX	33	A fax modem connection is established in a facsimile mode

DATA	35	A data modem connection is established in a facsimile mode
+FCERROR	+F4	High speed fax data (V.27, V.29, V.33, V.17) is expected and a V.21 signal is received

3 - S REGISTER REFERENCE

Your modem has status registers. These registers are memory locations inside your modem which control your modem operation. You usually do not have to worry about setting any register because the default values work for most applications.

The factory default values are stored in Product Configuration File and are loaded into the active configuration at power up or by the Z command. In addition, the default profile is subsequently loaded, and may change some of the factory default value. The S registers are summarized in Fig. 3-1, along with their default values.

3.1 Register Summary

The following chart summarizes your modem? registers:

Reg.#	Range	Unit	Dec	Hex	Default Description
S0	0 - 255	rings	0	00h	Number of rings before autoanswer.
S1	0 - 255	rings	0	00h	Ring counter.
S2	0 - 255	ASCII	43	2Bh	Escape character code.
S3	0 - 127	ASCII	13	0Dh	Command terminator (<CR>character).
S4	0 - 127	ASCII	10	0Ah	Line feed character.
S5	0 - 255	ASCII	8	08h	Backspace character.
S6	2 - 255	seconds	2	02h	Wait time for blind dialing.
S7	1 - 255	seconds	50*	32h	Wait time for carrier after dial.
S8	0 - 255	seconds	2*	02h	Pause time for comma (dial delay).
S10	1 - 255	1/10 sec.	14*	0Eh	Lost carrier to hang-up delay.
S11	50 - 255	1/1000 sec.	95	5Fh	DTMF Tone Duration.
S12	0 - 255	1/50 sec.	50*	32h	Escape code timing.
S29	0 - 255	10 ms	70*	00h	Flash Dial Modifier Time.
S95	[Bit mapped]		0*	00h	Extended result codes.

Fig. 3-1 S-Register Summary

3.2 Glossary of the S Registers

S0 Number of Rings Before Auto Answer

S0 determines the number of rings that must be received before the modem automatically answers an incoming call. For example, when **S0=3**, the modem automatically answers after the third ring. When **S0=0**, the modem does not automatically answer an incoming call; it stays on-hook until the **A** command is issued manually to answer the incoming call.

Range: 0 - 255 rings
Default: 0

S1 Ring Counter

S1 automatically increments its value by one each time the modem receives a ring while in the command state. **S1** is reset to zero if no ring is detected within **8** seconds.

Range: 0 - 255 rings
Default: 0

S2 Escape Character

S2 stores the ASCII value of the escape character. Setting register **S2** to a value greater than 127 disables the escape command and you cannot return to the command state. With escape disabled, in the on-line state the modem cannot hang up until the power is turned off or the remote modem hangs up.

Range: 0 - 255, ASCII decimal.
Default: 43 (+)

S3 Line Termination Character

S3 sets the decimal value of the command line and result code terminator character. Pertains to asynchronous operation only.

Range: 0 - 127, ASCII decimal.
Default: 13 (Carriage Return)

S4 Response Formatting Character

S4 sets the decimal value of the character generated by the modem as part of the header, trailer, and terminator for result codes and information text, along with the S3 parameter. If the value of S4 is changed in a command line, the result codes issued in response to that command line will use the new value of S4. The Response Formatting character is output after the Line Termination character if verbose result codes are used.

Range: 0 - 127, ASCII decimal.
Default: 10 (Line Feed)

S5 Command Line Editing Character

S5 sets the decimal value of the character recognized by the modem as request to delete from the command line the immediately preceding character. This character can be use to edit a command line. When the echo command is enabled, the modem echoes back to the local DTE the Command Line Editing character, an ASCII space character and a second Command line Editing character; this means a total of three characters are transmitted each time the modem processes the Command Line Editing character.

Range: 0 - 32, ASCII decimal.
Default: 8 (Backspace)

S6 Wait Time for Dial Tone before Blind Dialing

S6 controls how long the modem waits after it goes off-hook before it dials the first digit of the telephone number. The modem always pauses for at least 2 seconds, even if **S6** is set to less than two seconds.

Range: 2 - 255 seconds.
Default: 2

S7 Wait for Carrier after Dial

S7 controls how long the modem waits for a carrier signal from a remote modem after originating a call or from the calling modem after going off-hook when answering a call.

S7 also controls how long the modem waits for a one-second continuous dial tone after dialing a number followed by the **W** dial modifier. If the modem detects a one-second continuous dial tone within the specified wait time, it proceeds to dial.

Range: 1 - 255 seconds.
Default: 50

S8 Pause Time for Dial Delay

S8 controls how long the modem pauses when a comma "**,** " is encountered in a dial string while executing a dial command.

Range: 0 - 255 seconds.
Default: 2

S10 Delay between Loss of Carrier and Hang Up

S10 determines the delay time between the loss of a carrier from the remote modem and hang-up. This allows for a temporary loss of carrier without causing the local modem to disconnect. When **S10** is set to 255, the modem functions as if a carrier is always present.

The actual interval the modem waits before disconnecting is the value in **S10** minus the value in **S9**. Therefore, the value in **S10** must be greater than that in **S9**, or else the modem disconnects before it recognizes the carrier.

Range: 1 - 255 tenths of a second.
Default: 14 (1.4 seconds)

S11 DTMF (Touch-tone) Tone Duration

S11 determines the duration and spacing of tones for Dual Tone Multifrequency (DTMF) dialing. This value has no effect on pulse dialing.

Range: 50 - 255 milliseconds.
Default: 95

S12 Escape Prompt Delay (EPD)

S12 defines the maximum period, in fiftieths of a second, allowed between receipt of the last character of the three escape character sequence from the DTE and sending of the **OK** result code to the DTE. If any

character are detected during this time, the **OK** will not be sent . Note that sending of the **OK** result code does not affect entry into command mode

Range: 0 - 255 1/50 of a second.
Default: 50 (1 second)

S29 Flash Dial Modifier Time

Range: 0 - 255 tenths of a second
Default: 70 (disable)

S95 Extended Result Codes

This register can override some of the **&W** command options. Set the appropriate bit to 1 to enable the corresponding result code, regardless of the **&W** command setting Set the bit to 0 to disable the result code.

Bit	Description
0	CONNECT indicates DCE speed.
1	Append /ARQ to the CONNECT result code if the protocol is other than NONE.
2	CARRIER result code.
3	PROTOCOL: result code.
4	Reserved.
5	COMPRESSION: result code.
6	Reserved.
7	Reserved.

4 - TROUBLESHOOTING GUIDE

This chapter describes common problems in the installation, configuration and regular usage of your Fax/Data Modem. To test the Fax/Data Modem, a communication software package is needed and the package must include a mode that allows you to operate your Fax/Data Modem by directly issuing internal commands to the modem.

Follow the procedures in the following sections to resolve these common problems:

No Response From Your Modem

1. If you are using the internal add-on card modems, make sure that the COM port address you have set your modem to corresponds to the appropriate selection in the communications software which you are using.

2. Issue the **ATZ** command to reset your modem. The returned result code should be "0" or "K" depending on what communications program you are using. Your modem is OK if you get one of these responses. If there is no response after issuing the **ATZ**<CR>, continue to the next step.

3. Check if there are any other interface cards in your computer that use the same COM port address as your modem. If so, you must set your modem to another COM port address.

4. Issue the command: AT&F&W <CR>, if a "0" or "K" result code is displayed on the screen, your modem is OK. Otherwise, contact your dealer for assistance.

Your Modem Does Not Connect After It Has Dialed a Phone Number

The problem may have several causes. The phone line may be too noisy or the telephone cord may be poor. Try the line with a regular phone. Also the remote modem may not recognize your modem baud rate.

Your Can Transmit After You Have Connected to the Remote Modem

In this case, check the communication parameters of the remote modem, then configure your software to the same number of data bits, stop bit, and parity.

5 - APPLICATION EXAMPLES

5.1 Dialing a Remote Modem

Command line: ATDP9WT002, (886)-7128423<CR>

This command line instruct the modem to dial a remote modem through a PBX. The modem first use pulse dialing to dial 9 (the access code of the PBX), wait for outside dial tone, and then use touch tone dialing to dial 002 once a one-second continuous dial tone is detected within 30 seconds, pause for 2 seconds (if S8=2) and then dial 8867128423.

5.2 Manual Answer an Incoming Call

Command line: **ATA <CR>**

The factory setting of the S-register S0 is S0=0. This condition disables the auto answer capability so that you must issue an ATA command to answer a call. At power up, your modem always monitors if there are incoming rings. If incoming rings are detected, your modem will display result codes on the screen as :

RING
:
:
RING

Seeing that, you may issue the ATA command to answer the call. This command must be entered within the quiet interval between any two rings.

5.3 Auto Answer an Incoming Call

Command line: **AT S0=2 <CR>**

Auto answer can be enabled by changing the setting of the S-register S0 to a value between 1 and 255. In the above command line, S0=2 instructs the modem to answer an incoming call automatically after the 2nd ring.

This example also shows the insertion of space between two neighboring commands to make the command line more readable.

A - CALLER ID & DSVD COMMANDS

+VCID (Option) Caller ID (Enables or disables Caller ID.)

This command only apply to models which support the Caller ID function.

+VCID=0 Disables Caller ID.(Default.)

+VCID=1 Enables Caller ID with formatted presentation to the DTE. The modem will present the data items in a <Tag><Value> pair format. The expected pairs are data, time, caller code (telephone number), and name.

Inquiries :

+VCID? Reporting Current or Selected Values.

+VCID=? Reporting Supported Range of Parameter Values.

Formatted Form Reporting

The modem presents the data in the <tag>=<value> pair format as described in the table below. Spaces are present on both sides of the equal sign.

TAG	Description
DATE	DATE=MMDD where MM is the month number(01 to 12) and DD is the day number (01..31).
TIME	TIME=HHMM where HH is the hour number (00 to 23) and MM is the minute number (00 to 59).
NMBR	NMBR=<number> or P or O where <number> is the telephone number of the caller,where P indicates that the calling number information is not available since the originating caller has requested private service, and where O indicates that the calling number information is not available or out of service at the calling location.
NAME	NAME=<listing name> where <listing name> is the subscription name.
MESG	MESG=<data tag><length of message><data><checksum> in printable ASII hex numbers. This tag indicates a data item not listed above. The message is only possible for Multiple Message Format.

Notes:

1. The modem does not present any Caller ID information if the DCE detects a checksum error in the Caller ID packet.

2. In the event of an unrecognized data tag, the modem will present the data in ASCII hex numbers following the MESG tag.

Example of Formatted Form Reporting

1. The following example illustrates the standard Caller ID message packet.

RING

DATE = 0321
TIME = 1405
NMBR = 504551234
NAME = A N OTHER

RING

RING

2. The following example illustrates the case where the tag of the packet is not recognized by the modem.

RING

MESG = 06034242431

RING

RING

Unformatted Form Reporting

The modem presents all information and packet control information found in the message. The modem, however, excludes the leading U(channel seizure information) from the presentation. The packet is presented in ASCII printable hex numbers, the modem does not insert spaces, or line feeds, for formatting between bytes or words of the packet. The modem does not detect the checksum of the packet.

Example of Unformatted From Reporting

RING

0412303332323234303539313435353132333435

RING

RING

-SSE (Option) Enable/Disable DSVD

Syntax

-SSE=[<value>]

Defined Values

<value>

0 **:** Disable DSVD. (Default)

1 **:** Enable DSVD.

B - TECHNICAL SPECIFICATIONS

B.1 Features

Data Rates(bps)

300, 1200, 2400, 4800, 7200, 9600, 12000, 14400, 19200,
21600, 24000, 26400, 28800, 31200, 32000, 33600, 34000,
36000, 38000, 40000, 42000, 44000, 46000, 48000, 50000,
52000, 54000, 56000
54667,53333,50667,49333,46667,45333,42667,41333,
38667,37333,34667,33333,30667,29333.

Compatibility

(Data) ITU-T V.34, V.32 bis, V.32, V.22 bis, V.23, V.22, and V.21
Bell: 212A and 103, Rockwell V.Fast Class, K56flex, V.90
(Fax) ITU-T V.17, V.29, V.27 ter, and V.21 ch 2

Command Set Enhanced 'AT' command set, Fax Class 1 & Class 2 command

Flow Control Xon/Xoff, Hardware RTS/CTS

Data Compression V.42bis, MNP5

Error Correction V.42, MNP 2-4

Modulation

Data	56000, 54000, 52000, 50000, 48000, 46000, 44000, 42000, 40000, 38000, 36000, 34000, 32000, 54667, 53333, 50667, 49333, 46667, 45333, 42667, 41333, 38667, 37333, 34667, 33333, 30667, 29333bps		PCM
	33600, 31200, 28800, 26400, 24000, 21600, 19200, 16800, 14400, 9600, 7200bps		TCM
	9600, 4800bps		QAM
	2400, 1200, 600bps	DPSK	
	1200Tx/75Rx, 75Tx/1200Rx, 300bps		FSK
Fax	14400, 9600, 7200, 4800bps		QAM
	4800, 2400bp		DPSK

Operation Full-or Half-duplex 28800 bps with 26400, 24000, 21600, 19200, 14400, 9600, 4800, 2400 and 1200 bps auto fallback

Audio Monitor Built-in speaker, with software-controllable volume control
Guard Tone 1800 Hz

Compatibility:

Data	V90	56000/54667/53333/52000/50667/49333/48000, 46667/45333/42667/41333/40000/38667/37333, 36000/34667/33333/32000/30667/29333/28000 bps.
	K56flex	56000/54000/52000/50000/48000/46000/44000/42000 /40000/38000/36000/34000/32000 bps
	V.34	33600/31200/28800/26400/24000/21600/19200/16800/14400
	ITU-T V.32bis	14400/9600 bps, asynchronous, synchronous

	ITU-T V.32	9600/4800 bps, asynchronous, synchronous
	ITU-T V.22 bis	2400/1200 bps, asynchronous, synchronous
	ITU-T V.23	1200/75 bps, asynchronous, synchronous
	ITU-T V.22	1200 bps, asynchronous, synchronous
	ITU-T V.21	300 bps, asynchronous
	Bell 212A	1200 bps, asynchronous, synchronous
	Bell 103	300 bps, asynchronous
Fax	ITU-T V.17	14400/9600 bps, half-duplex
	ITU-T V.29	9600/7200 bps, half-duplex
	ITU-T V.27 ter	4800/2400 bps, half-duplex
	ITU-T V.26 A	2400, half-duplex
	G - III	(Group 3 fax)

Compliance FCC Part 15 & Part 68

Transmit Level -15(+/-2)dBm

Receive Sensitivity -38dBm

Pulse Dialing Specifications

	USA
Make/Break Ratio	39/61
Break Length	61ms
Dial Pulse Length	100m
Dial Pulse Rate	10pps
Interdigit Time	>600ms

C - QUICK REFERENCE

A Go On-line in Answer Mode

D Go On-line in Originate Mode

En Command Echo

Hn Hang Up

In Identification

Ln Control Speaker Volume

Mn Monitor Speaker On/Off

On Return to On-line Data Mode

P Set Pulse Dial as Default

Q	Result Code Display
Sn	Reading and Writing to S Registers
T	Set Tone Dial as Default
Vn	Select Word or Digit Result Codes
Wn	Connect Message Control
Xn	Extended Result Codes
Z	Reset
&Cn	RLSD Options
&Dn	DTR Option
&F	Fetch Factory Configuration
&Gn	Set Guard Tone
&Pn	Select Pulse Dialing Make/Break Ratio
&V	View Configuration Profiles
&Wn	Store the Current Configuration to Nonvolatile RAM
%En	Enable/Disable Line Quality Monitor and Auto-Retrain or Fallback/Fall Forward
%L	Report Received Signal Level (Option)
%Q	Line Signal Quality (Option)
+DR	Data Compression Report.
+DS	Data Compression.
+EB	Break Handling in Error Control Operation.
+ER	Error Control Report.
+ES	Error Control and Synchronous Mode Selection.
+IFC	DTE-Modem local Flow Control(XON/XOFF).
+MR	Modulation Report Control
+MS	Select Modulation
+VCID	Caller ID (Enables or disables Caller ID.) (Option)
-SSE	Enable/Disable DSVD (Option)

@ Wait for silence

, Pause

! Initiate a Hookflash

; Return to Command State after Dialing

^ Tone Control

L Re-dial Last Number

P Pulse Dialing

T Touchtone Dialing

W Wait for Dialtone

A/ Repeat Command

+++ Escape

D - GLOSSARY

ASCII - An acronym for American Standard Code for Information Exchange. ASCII is a seven-bit code which defines 128 standard characters, including control characters, letters, numbers, and symbols. An extra 128 characters comprise the extended ASCII set.

Baud Rate - The transmission rate between two serial devices, e.g., modems, fax machines, etc. Measured in Bits Per Second.

Blind Dialing - In blind dialing, the modem continues to dial, regardless of the existence of a dialtone, ring, or busy signal.

BPS - Bits Per Second; the number of bits that can be transmitted in one second.

Carrier Signal - The analog data signal that a modem sends over telephphone wires.

COMx - Where (x = 1, 2, 3, or 4), COMx is the name(address) of serial communications ports on personal computers. Each serial port in a personal computer has a different number.

CTS - Clear To Send.

Default - The assumed value that is used for a command parameter when no other value is explicitly provided.

DCD - Data Carrier Detect.

DCE - Data Communication Equipment.

DTE - Data Terminal Equipment.

DTMF - Dual Tone Multifrequency(for touchtone dialing).

DTR - Data Terminal Ready.

FSK - Frequency Shift Keying.

Make/Break Ratio - The ratio of the off-hook (make) to on-hook (break) interval is the make/break ratio in pulse dialing.

Modem - A combination of the words MOdulator and DEModulator. Modems transform digital data into analog signals and back again.

Nonvolatile Memory - An area of memory inside the modem where the default configuration profile is stored. Values recorded in this memory will not be lost when the power is turned off.

Off-Hook - The condition when the modem has picked up the telephone line.

Off-Line Command State - A modem state in which the modem accepts, interprets and executes commands from an asynchronous computer or terminal.

On-Hook - The condition when the modem has not picked up the telephone line; the telephone is hung up.

On-Line - A carrier signal link with a remote modem has been established; communication is in progress.

On-Line State - A modem state in which the modem is connected with a remote modem. Data can be sent or received from the remote modem in this state. No commands will be accepted from the modem except the escape command which will bring the modem into the on-line command state.

On-Line Command State - A modem state in which the modem can accept or execute commands from an asynchronous computer or terminal while remaining connected with the remote modem. The user can return the modem to the on-line state by issuing the **AT0n** command or put it into the off-line command state by issuing command such as **ATZ** or **ATH**.

Parity - An error-checking method by which the modem verifies that the data just sent is correct.

pps - Pulse per second.

Profile - A list of default settings.

Protocol - A technical specification for serial communications.

PSK - Phase Shift Keying.

Pulse Dialing - A dialing form in which each digit is represented by a series of pulses. Rotary telephones all use pulse dialing.

QAM - Quadrature Amplitude Modulation.

Result Codes - The response the modem returns to the screen upon executing a command.

RTS - Request To Send.

RX - Reception.

S Register - RAM locations in the modem which store the active configuration.

Serial Port - See COMx.

TCM - Trellis-Coded Modulation.

Touchtone Dialing - A dialing format in which each digit is represented by a musical frequency.

TX - Transmission.

E - ASCII CODE TABLE

Decimal	Hex	Value	Decimal	Hex	Value	Decimal	Hex	Value	Decimal	Hex	Value
000	00	NUL	032	20	(space)	064	40	@	096	60	'
001	01	SOH	033	21	!	065	41	A	097	61	a
002	02	STX	034	22	"	066	42	B	098	62	b
003	03	ETX	035	23	#	067	43	C	099	63	c
004	04	EOT	036	24	$	068	44	D	100	64	d
005	05	ENQ	037	25	%	069	45	E	101	65	e
006	06	ACK	038	26	&	070	46	F	102	66	f
007	07	BEL	039	27	'	071	47	G	103	67	g
008	08	BS	040	28	(	072	48	H	104	68	h
009	09	HT	041	29	)	073	49	I	105	69	i
010	0A	LF	042	2A	*	074	4A	J	106	6A	j
011	0B	VT	043	2B	+	075	4B	K	107	6B	k
012	0C	FF	044	2C	,	076	4C	L	108	6C	l
013	0D	CR	045	2D	-	077	4D	M	109	6D	m
014	0E	SO	046	2E	.	078	4E	N	110	6E	n
015	0F	SI	047	2F	/	079	4F	O	111	6F	o
016	10	DLE	048	30	0	080	50	P	112	70	p
017	11	DC1	049	31	1	081	51	Q	113	71	q
018	12	DC2	050	32	2	082	52	R	114	72	r
019	13	DC3	051	33	3	083	53	S	115	73	s
020	14	DC4	052	34	4	084	54	T	116	74	t
021	15	NAK	053	35	5	085	55	U	117	75	u
022	16	SYN	054	36	6	086	56	V	118	76	v
023	17	ETB	055	37	7	087	57	W	119	77	w
024	18	CAN	056	38	8	088	58	X	120	78	x
025	19	EM	057	39	9	089	59	Y	121	79	y
026	1A	SUB	058	3A	:	090	5A	Z	122	7A	z
027	1B	ESC	059	3B	;	091	5B	[	123	7B	{
028	1C	FS	060	3C	<	092	5C	\	124	7C	|
029	1D	GS	061	3D	=	093	5D	]	125	7D	}
030	1E	RS	062	3E	>	094	5E	^	126	7E	~
031	1F	US	063	3F	?	095	5F	_	127	7F	DEL